INVESTIGATION OF PIPERONYL BUTOXIDE-ENHANCED DELTAMETHRIN TREATMENT ON *Anopheles gambiae* IN OTA, OGUN STATE

AZEEZ, BLESSING OPEYEMI
(22PCP02380)
B.Sc Biochemistry, University of Lagos, Akoka

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (M.Sc) IN BIOCHEMISTRY IN THE DEPARTMENT OF BIOCHEMISTRY, COLLEGE OF SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY, OTA, OGUN STATE, NIGERIA

AUGUST, 2024.

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of a Master of Science (M.Sc.) in Biochemistry in the Department of Biochemistry, College of Science and Technology, Covenant University, Ota, Nigeria.

Miss Adefunke F.Oyinloye
(Secretary, School of Postgraduate Studies) **Signature and Date**

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) **Signature and Date**

DECLARATION

I, **AZEEZ, BLESSING OPEYEMI (22PCP02380),** hereby declare that this research work was carried out by me under the supervision of Dr. Wisdom D. Cleanclay (Supervisor) of the Department of Biochemistry, College of Science and Technology, Covenant University, Ota, Ogun State. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation were duly acknowledged**.**

AZEEZ, BLESSING OPEYEMI

Signature and Date

CERTIFICATION

We certify that the dissertation titled "**INVESTIGATION OF PIPERONYL BUTOXIDE-ENHANCED DELTAMETHRIN TREATMENT ON *Anopheles gambiae* IN OTA, OGUN STATE**" is an original work carried out by **AZEEZ BLESSING OPEYEMI (22PCP02380)** in the Department of Biochemistry, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Dr. Wisdom D. Cleanclay. We have examined and found this work acceptable as part of the requirement for the award of Master of Science (M. Sc.) degree in Biochemistry.

Dr. Wisdom D. Cleanclay
(Supervisor) **Signature and Date**

Prof. Solomon O. Rotimi
(Head of Department) **Signature and Date**

Prof. Oluwatosin B. Adu
(External Examiner) **Signature and Date**

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) **Signature and Date**

DEDICATION

This dissertation is dedicated to God Almighty, who in his infinite mercies granted me intellectual and physical strength to complete this work.

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ABSTRACT

Malaria remains a significant global health burden, with an estimated 247 million cases and 619,000 deaths in 2021. Sub-Saharan Africa is the most affected region. The primary vectors are female *Anopheles* mosquitoes, and their control is increasingly challenged by resistance to insecticides such as organochlorines, organophosphates, carbamates, and pyrethroids. This study focuses on the role of piperonyl butoxide (PBO) in enhancing the efficacy of deltamethrin (a pyrethroid) in Ota, Ogun State. PBO is known to inhibit cytochrome P450 enzymes, which detoxify pyrethroids in resistant mosquitoes. Two to five-day-old female mosquitoes that had not been fed blood were exposed to 0.05% deltamethrin alone and deltamethrin with 4% PBO according to WHO standards. The Knockdown resistance (kdr) genes were also genotyped to identify resistance mutations. The result showed that *Anopheles gambiae* exhibited significant resistance to deltamethrin alone (7.5% mortality). However, the addition of PBO increased deltamethrin efficacy, resulting in an 80.7% mortality rate. The increased susceptibility of the sample population to pyrethroids when used alongside PBO suggests the likely involvement of metabolic resistance. Kdr genotyping revealed the presence of the L1014F mutation, indicating kdr-West resistance. These findings suggest that incorporating PBO into vector control strategies could improve pyrethroid effectiveness and contribute to better malaria control.

Keywords: malaria, mosquito, synergist, pyrethroids, metabolic resistance